HIV preexposure prophylaxis in the United States: impact on lifetime infection risk, clinical outcomes, and cost-effectiveness

Paltiel AD, Freedberg KA, Scott CA, Schackman BR, Losina E, Wang B, Seage GR, Sloan CE, Sax PE, Walensky RP

Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

CRD summary
The objective was to model the clinical and economic outcomes and epidemiology of prophylaxis before exposure to human immunodeficiency virus (HIV), using tenofovir plus emtricitabine. The authors concluded that prophylaxis could substantially reduce the risk of HIV infection, but this did not justify its cost. Reductions in price, increases in efficacy, and targeting might make it more cost-effective. The methods were not adequately reported, but the rest of the reporting was satisfactory and the results appear to be reliable.

Type of economic evaluation
Cost-effectiveness analysis, cost-utility analysis

Study objective
The objective was to assess the clinical and economic outcomes and epidemiology of pre-exposure prophylaxis against human immunodeficiency disease (HIV), using tenofovir plus emtricitabine, to identify the circumstances in which pre-exposure prophylaxis might be viable.

Interventions
Prophylaxis before exposure to HIV, using tenofovir-emtricitabine (300mg of tenofovir plus 200mg of emtricitabine daily), as an addition to annual HIV screening, was compared with annual HIV screening alone.

Location/setting
USA/primary care.

Methods
Analytical approach:
The authors used a published state-transition model (Walensky, et al. 2006, see ‘Other Publications of Related Interest’ below for bibliographic details) to determine the clinical and economic impact of pre-exposure prophylaxis, using data from a range of sources. The target population was people at a high risk of HIV infection. The authors stated that the perspective was societal.

Effectiveness data:
The data were from a range of published sources, including randomised controlled trials and observational studies. The key clinical parameters were the lifetime risk of infection, the life expectancy, and quality-adjusted life-years.

Monetary benefit and utility valuations:
The utility estimates were those used previously in the model (Walensky, et al. 2006).

Measure of benefit:
The measure of benefit was quality-adjusted life-years (QALYs) gained and these were discounted at 3% per annum.

Cost data:
The analysis included the direct costs of the provision of prophylaxis (including drug and dispensing costs and the cost of monitoring). These costs were derived from a number of published sources, including the 2006 Red Book for the wholesale price of treatments, clinical laboratory fee schedules, and the 2006 Medicare physician fee schedule. They
were expressed in 2006 US dollars ($) and were discounted at a rate of 3% per annum.

Analysis of uncertainty:
A series of one-way sensitivity analyses was performed to assess the impact on the results of the uncertainty around the key parameters. The parameter estimates were varied across broad ranges.

Results
In a population at a high risk of HIV infection (mean age 34 years and 1.6% annual HIV infection incidence), the lifetime risk of HIV infection was 44% and the mean number of life-years was 39.9. The discounted survival for this group was 21.7 QALYs per person at a cost of $81,000. The tenofovir-emtricitabine pre-exposure prophylaxis reduced the lifetime infection risk to 25% and increased the mean number of life-years to 40.7. Prophylaxis increased the cost to $232,700 and increased the mean QALYs per person to 22.2.

The incremental cost per QALY for prophylaxis over no prophylaxis was $298,000.

Sensitivity analyses revealed more favourable cost-effectiveness ratios in younger age groups or if the efficacy of the treatment was assumed to be higher. For example, the cost-effectiveness ratio was $107,000 per QALY when assuming that prophylaxis prevented 90% of infections (50% in the base case).

Authors' conclusions
The authors concluded that pre-exposure prophylaxis could substantially reduce the risk of HIV infection, but this did not justify its cost. Reductions in the price, increases in the efficacy, and targeting of the treatment might make it more cost-effective.

CRD commentary
Interventions:
The intervention and the comparator were adequately described and an appropriate and conservative comparator was used and was a realistic clinical option available at the time.

Effectiveness/benefits:
The efficacy data were from a number of studies with variable methodological quality. The data for toxicity and the resistance to treatment were primarily from randomised controlled trials and observational studies. The key clinical inputs were detailed in a table, but their sources were not described in any detail. The details of the source and type of utility data were not reported, which means it is not possible to assess if these were appropriate or if the best available evidence was used. The outcomes of the study were well-defined and were used as the basis for an incremental analysis, which enabled a direct comparison of the strategies. The authors did not specify the time horizon, but described the results in terms of the patient's lifetime.

Costs:
The perspective was clearly defined and the relevant costs appear to have been included. The sources of data were provided, with a table detailing the cost items, which will allow the results to be replicated for other settings. The cost estimates were relevant to the study and the setting. The price year and the use of discounting were defined.

Analysis and results:
The analytic approach was not reported satisfactorily; the model was not described and no diagram was given, but the authors did provide a reference for the model. The incremental analysis was appropriate for determining the relative cost-effectiveness of the strategies. The issue of uncertainty was addressed with one-way sensitivity analysis, but probabilistic sensitivity analysis would have been a better method of evaluating the impact of the uncertainty on the results in full. The reporting was good; the results of the base-case and the sensitivity analyses were reported, which enhances the generalisability of the results for other settings. The authors described the choices they made in defining the model, and also discussed the strengths and limitations of their study.

Concluding remarks:
The selection of the data and the reporting of the results were satisfactory, but the methods were not adequately
reported. The authors' conclusions appear to be appropriate and consistent with the evidence.

**Funding**
Funding received from the National Institute of Mental Health, the National Institute of Allergy and Infectious Diseases, the National Institute on Drug Abuse, and the Doris Duke Charitable Foundation.

**Bibliographic details**

**PubMedID**
19193111

**DOI**
10.1086/597095

**Original Paper URL**
http://www.journals.uchicago.edu/doi/abs/10.1086/597095

**Other publications of related interest**

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Adenine /analogs & derivatives /economics /therapeutic use; Adult; Anti-HIV Agents /economics /therapeutic use; Chemoprevention /methods; Computer Simulation; Cost-Benefit Analysis; Deoxycytidine /analogs & derivatives /economics /therapeutic use; Emtricitabine; HIV Infections /prevention & control; Homosexuality; Humans; Male; Organophosphonates /economics /therapeutic use; Risk Assessment; Tenofovir; United States

**AccessionNumber**
22009101237

**Date bibliographic record published**
24/02/2010

**Date abstract record published**
27/10/2010